

Achieving End Land Use Goals in Reclamation, Alberta: Focus on Coal-mining in the Eastern Slopes Region

Prepared for the Coal Association of Canada



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A. INTRODUCTION

This report provides several examples of reclamation activities that have achieved, or are on track to achieve, end land use goals in west-central Alberta. Examples are presented as direct quotes from reports published in articles, books, conferences, and the peer-reviewed literature. This is not a comprehensive list of all the technical advances and procedures that have occurred in Alberta's long history of mining and reclamation, but the list serves as an example of what can be achieved once an end land use goal is established.

Reclamation has made steady progress in Alberta since the first legislation was passed in 1963. Formal academic research as well as on site empirical experiments have resulted in increasingly sophisticated practice in terms of planning, soil salvage, soil handling and placement, establishment of native vegetation ground cover, establishment of shrub and tree growth, and provision of wildlife and fisheries habitat. These efforts have resulted in final landscapes that are topographically complex and biologically diverse. Many sites are positioned to become community assets once reclamation is finalized, the lands become certified, and the Mineral Surface leases are returned to the crown.

For a comprehensive look at the history of coal-mine conservation and reclamation in Alberta, an excellent resource is the book titled *Footprints, The Evolution of Land Conservation in Alberta* (Bott et al. 2016). The report writers were guided by a committee of reclamation practitioners from government and industry with vast experience, some going back to initial reclamation era of the 1960s and describes the development of regulations and practices over a period of some 50 years. In pages 67 to 69, the authors describe Alberta's history of coal mining beginning in 1874 with the opening of Alberta's first commercial coal mine on the Oldman River near present-day Lethbridge. Alberta's first anthracite coal development was located in the Bow Valley in 1883, followed by developments in the Crowsnest Pass in the late 1890s, Nordegg in 1914, and Alberta's Coal Branch, with production there peaking in 1929. Most of these mines were underground developments. Coal was used primarily by the railways for use in steam engines, and for home consumption, and thermal power plants in Saskatchewan. With the discovery of crude oil in Leduc in 1947 and the increased use of diesel power and hydro for energy uses, the demand for coal dwindled in the 1950s. By the late 1960s, plains coal was being used for new thermal electric power plants and demand for metallurgical coke for use in steel mills in Asia grew. The new mine developments moved away from underground mining and most new mines used surface techniques. These larger mines increased the potential for surface disturbance.

Alberta has a remarkable track-record of reclamation practice, research, and education programs. The first legislation in Canada dealing solely with reclamation was passed in Alberta in 1963. This was quickly followed by the development of several organizations, associations, and post secondary education programs dealing with various aspects of reclamation in the province. Appendix I provides a short overview of the purpose and goals of these organizations. The Reclamation Research Technical Advisory Committee (RRTAC) from 1978 to 1994, included specific coal mine research programs:

- The Plains Hydrology and Reclamation Program
- The Mountain-Foothills Reclamation Research Program

Much of the research on issues common to coal mining conducted by these organizations is supported by industry. The RRTAC coal mine projects were cooperatively undertaken by government and industry to advance reclamation practices.

The coal industry has also participated in cooperative studies on a broad range of subjects towards good environmental stewardship over a range of topics, including for example wildlife research on bighorn sheep populations and movement, grizzly bear use in and around coal mines, Harlequin Duck life history and habitat, and other topics such as lake fisheries, water quality issues and land use planning.

Various university and college courses provide reclamation training including Olds College, Lakeland College, Medicine Hat College, NAIT, SAIT and the University of Alberta.

The Alberta Chapter of the Canadian Land Reclamation Association formed in 1982 and has hosted annual reclamation conferences since then.

B. RECLAMATION IN ALBERTA

Land reclamation in Alberta is regulated by comprehensive legislation that directs developers to return disturbed lands to an **equivalent land capability**.

B.1. Definition of Reclamation

“Reclamation

(Rehabilitation/Restoration)

“The process of reconvertng disturbed land to its former or other productive uses.

“All practicable and reasonable methods of designing and conducting an activity to ensure:

- (1) stable, non-hazardous, non erodible, favourably drained soil conditions, and*
- (2) equivalent land capability.*

- (1) The removal of equipment or buildings or other structures and appurtenances,*
- (2) The decontamination of buildings or other structures or other appurtenances, or land or water,*
- (3) The stabilization, contouring, maintenance, conditioning, or reconstruction of the surface of land,*
- (4) Any other procedure, operation or requirement specified in the regulations. (Regulatory definition)”*

*– Glossary of Reclamation and Remediation Terms
Powter 2002 [page 59]*

B.2. Reclamation Requirements

“Concerns from farmers, landowners, outdoor enthusiasts, and municipalities led to Alberta’s first land reclamation legislation in 1963 – the first such law in Canada dedicated solely to reclamation...”

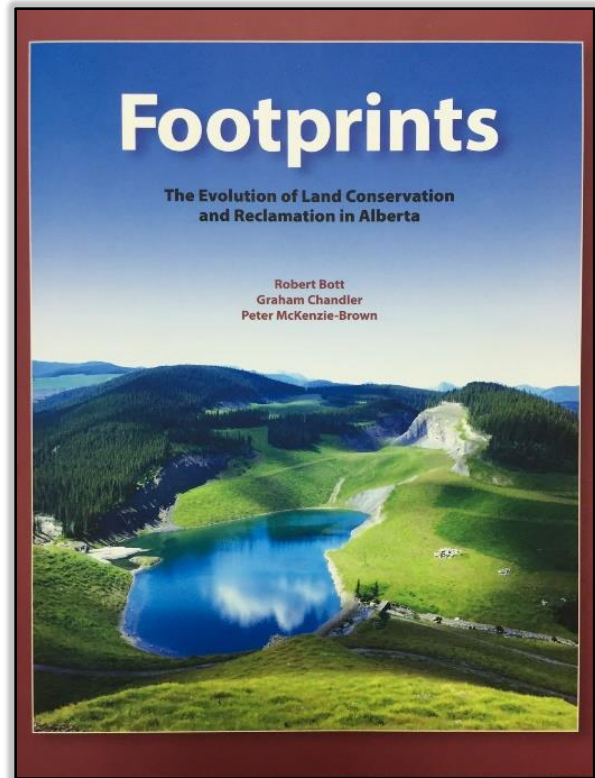
“Two kinds of large-scale land disturbance, surface coal mining and oil sands mining, emerged in the 1960s. To address concerns about the eventual reclamation of these excavations, legislation in 1973 required major projects to submit Environmental Impact Statements (EIAs). The assessments had to address issues that may arise before, during, and after construction and operation. The assessments, which could be subject to public hearings, had to include information about soils and landscapes before disturbance, and plans for reclamation after operations...”

“Conservation of topsoil became a legislated requirement in 1983, as did cleanup of contamination...”

“Until the mid-1980s, the objective of reclamation was ‘equal or better productivity’ compared to pre-disturbance. In other words, if the land grew a given amount of wheat before disturbance, it should grow at least that much after reclamation. This standard proved difficult to assess: weather conditions and land management practices such as applying fertilizer, for example, could alter productivity from year to year. In addition, reclamation of larger disturbances such as mines and pits could result in new features that were not directly comparable with the pre-existing condition – lakes for example, where there had been prairie...”

*“The goal gradually shifted to ‘**equivalent land capability**’ which was formally adopted in 1993 legislation. The landowner and/or government (provincial and municipal) would determine the desired **end land use**. In most cases Class 2 agricultural land would still be Class 2 agricultural land, but other options would be considered. **Vegetation would be one indicator of success, but it would not be the sole determining factor.**”*

– *Footprints, The Evolution of Land Conservation in Alberta*
Bott et al. 2016 [pages 7 – 9]



Cover image: Bob Logan
Photo of Sphinx Lake reclamation,
Luscar Mine, Alberta

B.3. Reclaimed Land Use Goals

Typically coal mines in the Eastern Slopes region of Alberta are located on crown lands. Government land management plans give key guidance for reclamation land use objectives and setting goals.

Regional ecosystems are another consideration in setting land use goals, particularly regarding wildlife populations and movement and water resources. Ecosystem considerations are integrated into mine plans at the environmental assessment and development approval stage.

Key objectives of reclamation programs include watershed protection, return of land capability, and establishing the ecological foundations to meet land use goals. Mine specific land use goals are developed considering the local environmental setting of the mine, the regional plans, the input of public, aboriginal, and other land users.

On completion of coal mining the reclaimed lands are returned to crown land. Post-mine land management plans are an important step in ensuring that reclaimed landscapes retain their ecological value into the future.

C. PUBLICATIONS AND ARTICLES REPORTING ON ACHIEVEMENT OF RECLAMATION END LAND USE GOALS (EXCERPTS)

C.1. Reclamation of the Gregg River Mine, Canada

*“Construction of the Gregg River Mine began in 1981. Coal production occurred continuously from 1983 through to October of 2000. With the closure of the mining operation, site activities switched entirely to completing reclamation of the 1,362 hectares of land that had been distributed over the life of the mine. **The Gregg River Mine was the first large scale open pit mine in Alberta closed under the current closure and reclamation legislature.***

“The mining and reclamation activities were influenced by a number of climatic, topographic, and geographic factors. The mine is located in west central Alberta on the east slopes of the Rocky Mountains, elevations range from 1,400 to 2,000 m and soils are generally thin and rocky. The climate is severely influenced by the mountains and the elevation; snow is common in all months of the year. Strong Chinook winds blow in the winter, melting and moving snow and creating a very difficult growing environment for plants and young seedlings.

“The initial five years of the reclamation programme concentrated on completing the recontouring of the disturbed surface, replacement of the previously salvaged surface soil and revegetation of the mining areas. This work included the removal of haul road river crossings, the relocation and reconstruction of surface water streams and the decommissioning of waste water treatment facilities. The second phase of the project was the demolition of the coal processing, equipment maintenance, load out and rail facilities. Soil remediation and land reclamation of these areas followed.

“The reclamation objective for the Gregg River Mine is equivalent land capability with designated reclaimed land use objectives for wildlife habitat and watershed protection. A measure of the achievement of equivalent capability and reclamation success may be the abundant wildlife and clear flowing streams throughout the site. Large bighorn sheep, deer, elk, coyote, wolf and grizzly bear populations may be seen on many areas of the site. Recent carnivore activity is one indication of the eventual return of a healthy, balanced and sustainable ecosystem to the reclaimed Gregg River mine site.”

– Reclamation of the Gregg River Mine, Canada



Brand and Etmanski 2011 [pages 219 – 226]

C.2. A Review of 23 Years of Grizzly Bear Research in and around Open Pit Coal Mines in Alberta

Some 25 years ago, through the development approval process, a potential impact on grizzly bears in the proposed Cheviot Mine development became a catalyst for the regional grizzly bear study conducted by the Foothills Research Institute.

*“In contrast to the predictions of the 1996 EIA that open pit coal mines in the region would create barriers to grizzly bear movement across the landscape, grizzly bears have been found to be highly adaptable to change, and reclaimed open pit coal mines in this region, with the current abundance of food resources, are in fact important habitats for resident grizzly bears. **There has been no evidence from long term research in this region that open pit coal mines are having a detrimental effect on regional grizzly bear populations.**”*

*“A goal of mine reclamation in these areas should be to recognize and maintain the valuable habitat for this threatened species. **In fact, reclaimed mines with access management and firearm restrictions can act as local refugia, or safe havens, for grizzly bear**¹. Mine reclamation can play a key role in grizzly bear population survival and conservation if bear-human conflict is kept low; however, if human access restrictions are removed, the reclaimed areas could quickly turn into a population sink, and area where grizzly bears are attracted to but face unsustainable levels of mortality². Landscape and vegetation restoration and enhancement as well as **careful planning regarding human access and activity** are important elements of an effective reclamation plan that will recognize the ecological needs of grizzly bears.”*

– A Review of 23 Years of Grizzly Bear Research in and Around Open Pit Coal Mines in West Central Alberta Final Report, Stenhouse and Parsons 2020 [page 18]



Photo: Grizzly bear sow and cubs grazing on reclaimed Gregg River Mine, July 1, 2011.

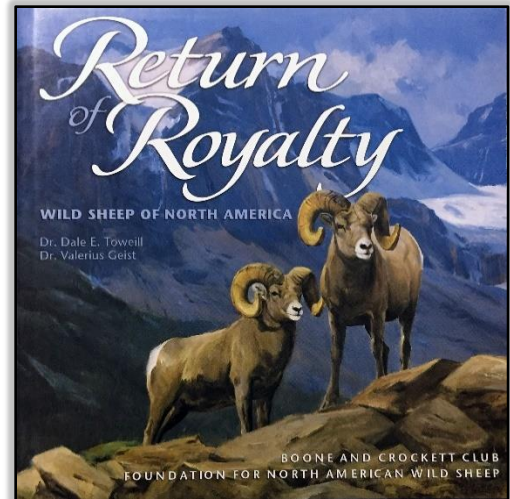
¹ Cristescu, B., Stenhouse, G.B., Symbaluk, M. Nielsen, S.E & Boyce, M.S. 2016. *Wildlife habitat selection on landscapes with industrial disturbance*. Environ. Conserv. doi:10.101, 1-10.

² Cristescu, B. 2013. *Grizzly bear response to open-pit mining in western Alberta, Canada*. PhD Thesis (University of Alberta).

C.3. Bighorn Sheep and Coal Mining

Creating Bighorn Sheep Habitat

Recognition that coal mines are part of a broader eco-system has long been acknowledged by the industry. The opportunity to employ Ian McHarg's "design with nature" concept to develop bighorn sheep habitat during reclamation of the Luscar Mine in west-central Alberta is described in MacCallum and Geist 1992. The effectiveness of the approach led to productive habitat and increased sheep populations. The Luscar Mine reclamation was recognized by the Alberta Government through the "Order of the Bighorn" conservation award (Appendix II).



The success of creating wildlife habitat from an open pit coal mine was published as a vignette in *Return of Royalty, Wild Sheep of North America* (Toweill and Geist 1999). This publication is a must-read for anyone interested in the progress of bighorn sheep recovery efforts in western North America.

*"April 1997 was a memorable day – the kind of day that makes the struggle of working in often hostile environments worthwhile. As a biologist, I had been darting bighorn sheep rams, so that I could remove non-functioning radio-collars when, while waiting for the drug to take affect on one of the darted rams, a pack of wolves moved out of the forest and began a cacophony of howls. Despite any anti-predator response that this may have elicited on the part of the ram as he was slipping from consciousness, I had to stop and admire the wolves. Earlier in the day a bald eagle had passed below us as it flew over the still ice-covered lake during its migration northward. And while I did not see a grizzly bear that day, bears had been observed nearby in other seasons. **These symbols of wilderness – bighorn sheep, gray wolves, bald eagles and grizzly bear – might have been expected had I been in a remote and protected area, but the rumble and hum of large trucks and machinery in the distance reminded me that I was, instead, in the center of an active open pit coal mine in the Alberta foothills.**"*

– *Return of Royalty, Wild Sheep of North America*
Toweill and Geist 1999 [pages 204, 205]

Identifying and Reclaiming for Wildlife Habitat in a Subalpine Environment

"Production of diverse wildlife habitat is a key part of the reclamation associated with mining in the Subalpine ecoregion of Alberta. Ecological attributes are seldom the same throughout large area disturbances and different reclamation strategies recognize this ecological diversity. End land use wildlife values often use umbrella species like ungulates because they function at a landscape level which reflect the overall ecological condition of the pre-disturbance environment. Life requirements for many bird or smaller mammalian species can often be fulfilled within a narrow habitat range and therefore these species are not appropriate for assessing an overall ecological condition. Use of umbrella species does not mean that only the needs of these species will be considered in the reclamation program. Rather, habitat requirements for the umbrella species serve as a guide to landscape level

decisions i.e., amount, type and placement of tree vegetation, shrub vegetation, and grassland vegetation, as well as landform shaping.

*“A variety of reclamation techniques are employed at the micro-site level to encourage diversity in the final landscape. Species with specialized requirements, such as riparian habitat or food plant requirements, are identified in the reclamation program and specific action taken to accommodate these needs. The long term and progressive nature of mining and reclamation means not all habitat will be disturbed at once and new habitats will become available before the end of the life of the mine. **Wildlife diversity is maintained by an ecosystem approach to reclamation that restores pre-mine habitat condition, replaces habitat function, and exchanges certain components for others of similar benefit.***

“Understanding the basic biology and habitat requirements of the umbrella species within the context of the mine development can lead to specific recommendations regarding the type and placement of landscape attributes in the site reclamation phase. On-going or periodic population monitoring maintains a continuous record of wildlife response to reclamation activities and can be used to integrate site reclamation techniques with adjacent undisturbed lands and previously reclaimed lands.”

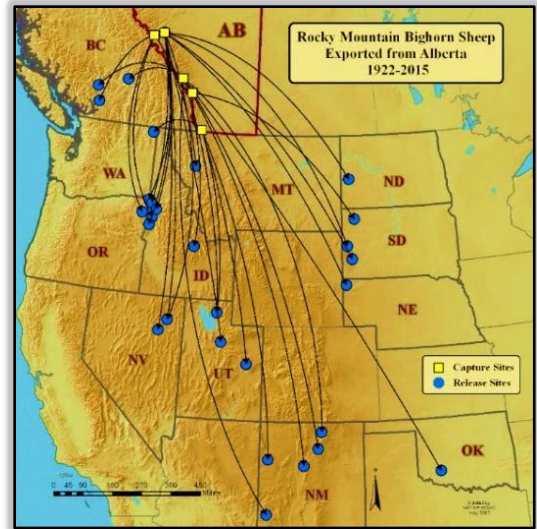
– *Reclamation to Wildlife Habitat in Alberta’s Foothills*
MacCallum 2003



Order of the Bighorn 1991
Alberta Government
Awarded to Cardinal River Coals

Reclaimed Mines as a Source Herd of Healthy Bighorn Sheep

Since 1985, 450 bighorn sheep have been exported from the Luscar and Gregg River reclaimed mines (often referred to as the Cadomin mines) to several locations in the US and Alberta. Of these sheep, 346 have gone to seven US states (Wild Sheep Working Group 2015) to help recover populations lost or diminished by settlement beginning in the 1880's and exposure to diseases carried by domestic sheep. The reclaimed mines were selected as a source herd for translocation programs due to the healthy and growing populations of bighorn sheep that were colonizing the newly available habitat. A health profile for these bighorns was provided to State biologists to accompany the exported bighorn sheep (MacCallum 2006). Bighorn sheep exported from the reclaimed Luscar and Gregg River mines are examined by veterinarians and biologists prior to export.



"The primary purpose of the health examination was to ensure the transplant sheep were free of any disease that would make them ineligible for export or affect their ability to withstand the rigors of transplant travel. Also, the sheep were examined for other health concerns that would affect their ability to be transported or decrease their ability to survive in their new location. Those health concerns included body condition, coat condition, free of leg problems and quality of foot and hoof. An integral part of survival in their new locations would be the ability to move easily so emphasis was placed on hoof and foot condition.

*"Clinical signs of chronic selenium toxicity includes cracked hooves, ill-thrift and possible changes to coat condition. **None of the animals I examined [>250] exhibited any signs of chronic selenium toxicity.**"*

*– Health Examination of Bighorn Sheep Captured at the Luscar Mine
MacLeod Veterinary Service, Brent MacLeod, D.V.M, 2005*

"When you think of significant Albertan exports, your mind might immediately jump to oil, meat, canola or even popular entertainers such as Jann Arden. But for the last decade the province has shared an important export of a different kind with our neighbours south of the border: Alberta's very own official mammal, the Rocky Mountain bighorn sheep.

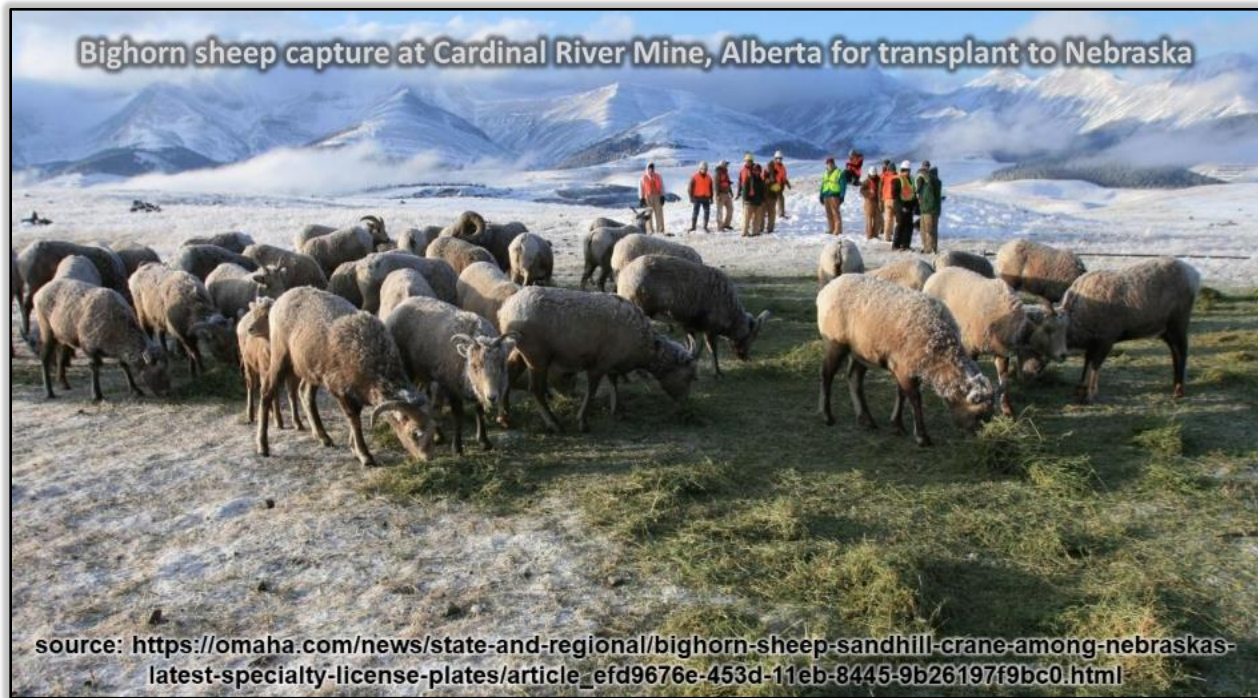
*"Rocky Mountain bighorn sheep range from British Columbia and Alberta south to Mexico, but a number of populations in the United States have undergone severe declines in the last century. In some areas, the sheep have been wiped out completely. But a program of cooperation between the Alberta and state governments aims to change that. **Bighorn sheep from a healthy population at the Luscar mine near Cadomin, Alta., are being transplanted to several American states to revitalize dwindling U.S. herds and save this regal creature from local extinctions.**"*

*– Bighorns on the Move
Canadian Geographic Magazine
Carol Hilton, October 14, 2008*

“Nebraska has been on a mission since 1981 to establish free-ranging bighorn sheep in the Pine Ridge and Wildcat Hills for viewing, photography and hunting. Last week, a team of 19 people gathered by the Nebraska Game and Parks Commission planted 40 bighorns in the Pine Ridge after a whirlwind, seven-day, 2,600-mile expedition to western Canada. The sheep were captured with Canadian help at a reclaimed coal mine near Hinton, Alberta.

“The original Nebraska bighorns began to disappear in the late 1800s, lost to declining habitat, unregulated hunting and disease carried by domestic livestock.”

– Bighorns Find a New Home in Nebraska
Omaha World-Herald
David Hendee, February 12, 2021



source: https://omaha.com/news/state-and-regional/bighorn-sheep-sandhill-crane-among-nebraskas-latest-specialty-license-plates/article_efd9676e-453d-11eb-8445-9b26197f9bc0.html

C.4. Fisheries and Aquatic Resources

As with terrestrial environments, aquatic resources are also a part of reclamation planning. Several examples of reclamation projects are provided. These projects have been awarded for their innovation and their development has resulted in a new set of techniques and expertise.

Constructing Habitat for a Sustainable Native Fisheries in the Sphinx Lake End Pit Lake System



Annotated photo of Sphinx Lake, Luscar Mine showing habitat features constructed during reclamation of a coal mine pit.



Major Reclamation Award 2006

Alberta Chamber of Resources

Awarded to Cardinal River Operations for Sphinx Lake reclamation work

*"Fisheries habitat and watershed integrity are highly valued resources in the subalpine natural subregion of west-central Alberta. Teck's Luscar open pit coal mine has been in operation in this area since 1969, and 51-C6 pit was mined from 1992 to 1999. Accomplishing a sound development and reclamation plan to meet biodiversity objectives for 51-C6 pit included operational considerations such as surface water diversions and post-mining fisheries habitat development. **The pit had to be mined and reclaimed such that the end pit and inlet/outlet streams would sustain in perpetuity the full range of habitat and watershed features needed to support native Athabasca Rainbow Trout (*Oncorhynchus mykiss*) and Bull Trout (*Salvelinus confluentus*).***

*"The five year post-reclamation fisheries habitat and population assessment **indicates a surging Rainbow Trout population**, high growth rates and enhanced habitat conditions as*

compared with the pre-mine cold-water, lotic system. This paper covers the process from environmental assessment through construction and reclamation to closure assessment, highlighting the challenges, uncertainties, and successes of Teck's award-winning Sphinx Lake system within the context of biological diversity."

*– Constructing Habitat for A Sustainable Native Fisheries
in the Sphinx Lake End Pit Lake System
Brinker et al. 2011 [pages 525 – 534]*

Evaluation of Reclaimed Wetland and Riparian Resources in Coal Valley Mine

"The Coal Valley Mine (CVM) has been in operation since 1978 and has a proven record in the quality of their mine reclamation. At the CVM, a terrain of lakes, wetlands, rolling grass and forested lands has been created that adds to ecological diversity, provides wildlife habitat, and creates recreational and commercial forestry opportunities. Part of this reclamation work has involved the creation of wetlands and riparian areas, which are of ecological and socio-economic importance...

"GDC performed a detailed survey of the vegetation, soils, and wetland types for 450 plots spaced along 157 transects in wetlands in the reclaimed area. This data was then compiled, and various analyses were used to assemble plots into ten wetland plant community groups with an additional 23 subgroups. In order to determine the degree to which the reclaimed wetlands resembled natural wetlands in the region, these groups were then compared to 52 plots from natural wetlands...

"The results show that wetlands in the reclaimed Coal Valley Mine area are providing a variety of ecological functions similar to natural wetland and riparian systems. The reclamation successes include:

- The creation of wetlands with zones closely resembling natural shrubby rich fens, which the Water Sedge Group and the Golden Moss Subgroup of the Timothy/Alsike Clover Group resembled.*
- The creation of wetlands with zones resembling natural sedge rich fens, which the Water Sedge and Beaked Sedge Groups resembled.*
- The creation of wetlands with zones resembling natural Lower Foothills marshes, which the Small-fruited Bulrush and Common Cattail Subgroups of the Slough Grass Group resembled.*
- The establishment of native species including lodgepole pine, willows, balsam poplar, river alder, water sedge, beaked sedge, short sedge, common horsetail, variegated horsetail, yarrow, tufted moss, and golden moss.*
- Six occurrences of rare plant species including a rare fern and four rare mosses.*
- An increase in habitat value for some species of fish and waterfowl.*
- An increase in the recreational fishing resource base, and as an attraction for tourism and recreation.*

"Most of the wetlands sampled did not closely resemble natural regional wetlands, but they do provide important ecological functions and services. Most natural wetlands in the area are Upper Foothills peatlands. Newly created wetlands in the reclaimed area require time for the peat to accumulate. With organic matter accumulation over time the soils and plant communities on these reclaimed sites are expected to become more similar to those of natural sites. Four sites had a zone resembling natural mineral-soil wetlands; that is, marshes or swamps. The young successional stages of other reclaimed wetlands were dominated by species not normally associated with regional successional mature

wetlands. Often these young, reclaimed wetlands had a relatively high proportion of non-native and/or weedy species. There were several factors that may improve the establishment and function of wetlands in the CVMl area. Eleven recommendations for future wetland reclamation, to help deal with these factors, were made.”

– *Evaluation of Reclaimed Wetland and Riparian Resources for Coal Valley Mine: EIA Report*
Geographic Dynamics Corp. 2007

Reclamation to Provide Fisheries Recreation Opportunity - Lovett and Silkstone Lakes

Lovett and Silkstone Lakes on the Coal Valley Mine have been reclaimed to a successful fisheries habitat. Rainbow Trout have been stocked at these lakes since 1995. A system of trails is maintained for the public to access the lakes providing recreational opportunity for fishers and hikers. Fishing regulations are listed in Appendix III. Coal Valley Mine received a major award from The Alberta Chamber of Resources for this work.



Lovett Lake, Coal Valley Mine (reclaimed mine pit)



Alberta Chamber of Resources Major Award 2006

Mine Reclamation

Luscar Ltd. – Coal Valley Mine – Lovett and Silkstone Lakes

Coal Valley Mine (CVM) has been in operation since 1978 and is owned by Luscar Ltd. At the Coal Valley Mine, located approximately 90 km south of Edson in the Coal Branch region of Alberta, a combination of dragline, and truck and shovel equipment was used to recover coal, and many of the final cuts resulted in planned end pit lakes, and low-lying areas.

During the early planning stages, in 1981, it was recognized that mine-cut lake development in the Alberta Foothills was in its infancy and largely conceptual. Coal Valley Mine retained the services of consultants to develop procedures for planning and development of lakes with fisheries potential. Guidelines were developed and used in the construction and development of lakes within the Coal Valley Mine permit boundary and specifically in the construction of Lovett and Silkstone Lakes.

The majority of development activities focused on re-sloping and leveling of the shoreline and bottom configurations, with additional topsoil replacement and vegetative seeding. Construction of Lovett and Silkstone Lakes was completed and final water elevations were achieved in 1985 and 1986, respectively. Additional development activities included the introduction of macrophytes and an isolated oxbow of the Lovett River.

Alberta Environment requires land be returned to a state of equivalent capability following an industrial activity. However, the land use may not be exactly the same as prior to the disturbance. When reclaiming end pit mines, there is the potential for multiple end land uses, and in the case of Silkstone and Lovett Lakes, one end land use is recreational fishing. Rainbow trout have been stocked at these lakes since 1995. Both Lovett and Silkstone Lakes have a shore and near shore zone, also known as a littoral zone, in excess of 30% of the lake area, which provides for a successful fisheries habitat. The aquamarine blue water has abundant corixid bugs, amphipods, mayfly nymphs and leeches to provide viable food source for stocked trout.

Fishers and hikers can also enjoy the trail system in the picturesque juvenile forest of predominantly pine trees inter-mixed with spruce that are approximately 2-3 meters in height. The irregular shape of shoreline and lake offers a number of outcroppings over endwall formations for angling pleasure.

Considered a jewel in the eye of Coal Valley Mines reclamation, the Silkstone and Lovett Lakes area is an excellent example of reclamation success and valuable teaching aid in the reclamation of other end pit lakes and wetland features. In addition, the project provides an opportunity to fish at two scenic lakes within a reclaimed portion of the Alberta Foothills. Luscar, in conjunction with Alberta Environment, annually provides stocked rainbow trout for public fishing and Luscar Ltd. maintains a parking area and foot access trail to the lakes for the enjoyment of visitors and fishermen.

C.5. Establishment of Trees and Shrubs on Mined Land

The Alberta Research Council (now part of Alberta Innovates) established a reclamation research program at the operations of Smoky River Coal Limited near Grande Cache in 1971. The overall objective was to develop and refine cost-effective methods of establishing and maintaining a vegetative cover that is in harmony with adjacent undisturbed areas. This work included a program to introduce trees and shrubs to a subalpine environment.

“This long-term reclamation research program demonstrates that trees and shrubs can be established in surface mined areas in the Subalpine. The methods that are utilized for a given location are dependent upon the end land use desired, the time frame allowed, and specific site conditions. The options available include the use of container and bare root stock, rooted and directly planted cuttings, direct seeding, and natural invasion”

– *Establishment of Trees and Shrubs on Mined Land in the Subalpine Region of Alberta*
In Proceedings of the 19th Annual British Columbia Reclamation Symposium
Terry M. Macyk, 1995 {pages 45 – 53}

C.6. Closure Planning

Reclamation examples in this report show that coal mines can be returned to equivalent land capability. Companies have an interest in how lands are managed post-mining, as they reflect the industry commitment to environmental conservation and protection. This is a developing area in which the coal industry has been, and will continue to be, an interested participant.

Balancing Focal Species, Recreation, and Biodiversity in Mountain Coal Mine Closure Planning – Alberta, Canada

*“Coal extraction in the Coal Branch region of Alberta, Canada has occurred since 1911 with surface mining dominating as of the 1940s. Coal mining in this mountain/foothills landscape now occurs in a multiple land use context along with oil and gas exploration and production, timber harvest, aggregate mining, big game hunting/guiding/outfitting, fur trapping, recreational All Terrain Vehicle (ATV) use, fishing, camping and other outdoor recreational pursuits. Currently, there are three surface coal mines in various stages of active mining, reclamation, and closure in the upper elevations of the Coal Branch region. Mining has taken place within an increasingly stringent regulatory framework. In the mid 1990s, application was made for the Cheviot mine project. Its proximity to Jasper National Park and heightened cumulative effects assessment requirements resulted in a ground-breaking series of public hearings, legal proceedings and two federal-provincial Joint Review Panels. **Focal wildlife species, with particular emphasis on large carnivores (grizzly bears) and ungulates (elk, bighorn sheep), were a major aspect of the Cheviot environmental impact assessments and subsequent research/monitoring.***

“The Cheviot Mine was approved in 2004 with the first of a series of mine licenses required through the phased mine development. A land use planning process (LUP) is on-going for the end land use close planning of two older coal mines (Luscar and Gregg River) located near the Cheviot Mine. This process is being informed by on-going ecological research and monitoring at all three mines. The issues and discussions surrounding the LUP are in turn informing the

Cheviot Mine permit application process. Three over-arching end land use goals dominate the current mine closure planning debate. They include: 1) maintaining and enhancing focal species habitat and populations as per the original Cheviot project mandate; 2) preserving either pre-disturbance or modified recreational land use opportunities; and 3) approximating pre-disturbance native biological diversity conditions. This paper discusses challenges and lessons learned over a 15-year period concerning the balancing of these three primary end land use goals.”

– *Balancing Focal Species, Recreation, and Biodiversity in Mountain Coal Mine Closure Planning*
Kansas and Symbaluk 2011 [pages 423 – 431]

“A major challenge for the future is to learn from the past and build on existing knowledge and expertise. Significant progress has been made in advancing reclamation practices in Alberta [since 1963].”

– *Footprints, The Evolution of Land Conservation in Alberta*
Bott et al. 2016 [page 205]

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APPENDIX I. SHORT LIST OF RECLAMATION RESEARCH PROGRAMS, ORGANIZATIONS AND ASSOCIATIONS IN ALBERTA

Development of environmental protection and land reclamation practices for coal mines has drawn from research on disturbed land reclamation across coal mines and other industrial sites, as principles from other disturbed sites, such as oil sands mining, can be helpful.

The Alberta Oil Sands Environmental Research Program (AOSERP)

AOSERP ran from 1975 to 1985 and carried out surveys and research aimed at identifying the potential long-term impacts of oil sands development. The program focused on land, water, air, and human systems and produced numerous reports. The program was managed by Alberta Environment. To view a list of available reports, please visit:

<http://www.osrin.ualberta.ca/Resources/DigitizedReports.aspx>

TAKE NOTE: These reports are provided to give context and historical information. As they are old they may contain references to out-of-date legislation and policies. Readers should be cautious when using these materials and always refer to current legislation and policies.

The Reclamation Research Technical Advisory Committee (RRTAC)

RRTAC was established in 1978 to manage the Alberta Government's reclamation research program, funded through the Alberta Heritage Savings Trust Fund's Land Reclamation Program. The research program focused initially on plains coal mining, then expanded to include mountain and foothills coal mining, oil sands mining and oil and gas. The program ran from 1978 to 1994 and produced numerous research reports. OSRIN (see below) has digitized 37 of the RRTAC reports including: • all of the reports prepared under RRTAC's Oil Sands Reclamation Research Program; • a number of reports of general interest (e.g., salinity, topsoil storage, plant suitability); and • reports from the other research program areas that address oil sands issues (Plains Coal – salinity, groundwater, soil characterization; Mountains and Foothills – wildlife habitat, tree growth, erosion).

TAKE NOTE: These reports are provided to give context and historical information. As they are old they may contain references to out-of-date legislation and policies. Readers should be cautious when using these materials and always refer to current legislation and policies.

Oil Sands Research and Information Network (OSIRIN)

The Oil Sands Research and Information Network (OSRIN) is a now closed (2009-2014) project of the University of Alberta's School of Energy and the Environment (SEE) It was a university-based, independent organization for compiling, interpreting and analyzing available knowledge about managing the environmental impacts to landscapes and water affected by oil sands mining and gets that knowledge into the hands of those who can use it to drive breakthrough improvements in regulations and practices. OSRIN was launched with a start-up grant of \$4.5 million from Alberta Environment and a \$250,000 grant from the Canada School of Energy and Environment Ltd. OSRIN provided:

- Governments with the independent, objective, and credible information and analysis required to put appropriate regulatory and policy frameworks in place

- Media, opinion leaders and the general public with the facts about oil sands development, its environmental and social impacts, and landscape/water reclamation activities – so that public dialogue and policy is informed by solid evidence
- Industry with ready access to an integrated view of research that will help them make and execute environmental management plans – a view that crosses disciplines and organizational boundaries

The report *“The OSRIN Story: Five Years of Creating and Sharing Oil Sands Environmental Management Knowledge”* summarizes the progress made by OSRIN from 2009 to 2014 in meeting its three mandates: 1. Creating oil sands environmental management knowledge by funding research – the emphasis was to be on mineable oil sands, not in-situ developments 2. Sharing oil sands environmental management information using a variety of different tools, and 3. Networking to help link researchers with funders and other researchers, and to enhance awareness of oil sands environmental management issues The following achievements reflect OSRIN’s efforts at meeting its mandates: • 80 research projects and workshops funded • 71 technical reports issued (one additional research report on heavy metals in mammals will be released early in 2015) • 39,771 downloads of OSRIN technical reports, staff reports and videos • 17 conferences sponsored.

InnoTech Alberta - A Subsidiary of Alberta Innovates

<https://innotechalberta.ca/services/ecosystem-plant-sciences/reclamation/>

The Reclamation team at InnoTech Alberta provides leadership on the development of applied, innovative, practical, and holistic land reclamation and remediation procedures and technologies for landscapes disturbed by industrial activities for the benefit of our partners, clients, and all Albertans. The Reclamation Team researches and develops strategies and technologies in the following focus areas: Native Plants, Waste to Use, Closure, Certification Validation and Risk Assessment, Monitoring.

Land Reclamation International Graduate School Faculty of Agricultural, Life & Environmental Sciences, University of Alberta

<https://lrigs.ualberta.ca/>

Land reclamation professionals are increasingly in demand. Our growing human population parallels a rapidly degrading arable land base from urban sprawl, soil erosion, resource extraction and industrial development. Thus, one of the most pressing challenges of the 21st century is to reclaim disturbed lands around the world to secure the livelihood of future generations. The Land Reclamation International Graduate School (LRIGS) helps to meet this challenge.

LRIGS provides collaborative and interdisciplinary training and professional development opportunities to graduate highly qualified land reclamation professionals with the education and experience necessary to take on leadership roles in academia, consulting, government, and industry. LRIGS is the first school of its kind in Canada and around the world, open to all undergraduate and graduate students and post doctoral fellows engaged in land reclamation and/or environmental research or programs, at the University of Alberta and other post secondary institutions.

Centre for Boreal Research, NAIT

<https://www.nait.ca/industry/applied-research/centre-for-boreal-research>

“Advancing research in boreal reclamation and peatland reforestation”

Our mission is to promote the informed use of boreal resources through applied science, education, and partnerships with industry, government agencies, practitioners, and academic partners. Programs include Forest Reclamation, Peatland Restoration, Boreal Forest Plant & Seed Technology Access Centre (TAC), Research Extension & Education.

Canada’s Oil Sands Innovation Alliance (COSIA)

“A catalyst for better environmental outcomes”

From exciting new scientific discoveries to game-changing technologies (and everything in between), our focus is on innovation. Explore research, innovation opportunities and projects within our priority areas: greenhouse gases, land, tailings, water. COSIA’s Land Environmental Priority Area (EPA) is focused on reducing the environmental impacts of oil sands mining and in situ operations on the land and wildlife of northern Alberta. Through collaborating with universities, government and research institutes, industry, and the wider public, the Land EPA brings together world-class expertise to address complex issues related to land management within Alberta’s boreal forests.

Alberta Chapter of the Canadian Land Reclamation Association

<https://www.clra.ca/alberta-chapter>

The chapter is a vibrant part of the reclamation movement within Alberta and includes private and corporate members alike.

Vision	<i>Recognized world leaders in the field of Reclamation for future generations.</i>
Mission	<i>Advancing, promoting, and celebrating the profession of reclamation through collaboration, education, and engagement with our members and the public.</i>
Values	<i>Connection-Responsibility-Integrity-Excellence-Recognition</i>

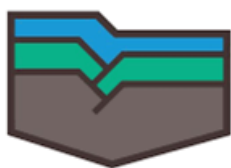
APPENDIX II. RECLAMATION AWARD ACHIEVEMENTS

The Alberta Chamber of Resources

The Alberta Chamber of Resources (ACR), originally founded in 1936 as the Alberta and Northwest Chamber of Mines, is a member-driven organization involved in resource development in Alberta. ACR members include mining, energy, forestry, pipelines, power generation, utilities, minerals, transportation and construction sector companies – those that create resource-based products and that provide the diverse infrastructure, products, and services essential to resource development. Among Canadian and international resource industry organizations, ACR is unique in its focus on Alberta; in bringing together companies across sectors and functions, as well as creating space for communication and collaboration among the members and between resource companies and development stakeholders.

Throughout its history, the ACR has been committed to improving workplace safety, developing innovative solutions and methods, best practices, Indigenous engagement, and cross-sector cooperation. We represent resource companies large and small, as well as members who work in engineering, logistics, transportation and other related industries. To learn more about our history, please see the resources listed below

Major reclamation awards (below) from the Alberta Chamber of Commerce illustrate the variety and complexity of reclamation successes in plains coal mining (Genesee Mine) and other sectors (i.e., industrial (Global Restoration Corporation), oil sands (Suncor Energy), oil and gas (Cenovus Energy Ltd.).



**ALBERTA CHAMBER
OF RESOURCES**

MAJOR RECLAMATION AWARDS

Global Restoration Corporation (2014)

Posted September 1, 2017 & filed under [Awards](#), [Major Reclamation Award](#).

2014 Major Reclamation Award – Global Restoration Corp. For a quarter-century, Global Restoration has been dedicated to assisting the natural restoration of land used for industrial purposes to forest and animal habitats. In doing so, it focuses on four key service areas: restoration planning and operations, mechanical site preparation, research and innovation, and native seed...

Suncor Energy (2010)

Posted September 1, 2017 & filed under [Awards](#), [Major Reclamation Award](#).

2010 Major Reclamation Award: Suncor Energy Suncor Energy has made strong advances in tailings pond reclamation at their oil sands mine north of Fort McMurray, Alberta. In 2010 Suncor became the first oil sands company to conduct surface revegetation of a tailings pond. As well, since 2003, Suncor has been researching, piloting and...

Alfred Burke – Cenovus Energy Inc. (2009)

Posted September 1, 2017 & filed under [Awards](#), [Major Reclamation Award](#).

2009 Major Reclamation Award (Alfred Burke, Cenovus Energy Inc) Alfred Burke accepted the ACR's Major Reclamation Award on behalf of Cenovus which operates oil and gas wells within a public grazing near Brooks, Alberta called Antelope Creek Ranch. The area is managed by Alberta Sustainable Resource Development and accommodates wildlife, waterfowl, cattle grazing and oil...

EPCOR & Sherritt Coal (2008)

Posted September 1, 2017 & filed under [Awards](#), [Major Reclamation Award](#).

EPCOR and Sherritt Coal- 2008 Major Reclamation Award Environmental work at Genesee Mine has returned 600 hectares into productive farm land and wildlife habitat, earning the mine partners, EPCOR and Sherritt Coal, the 2008 Alberta Chamber of Resources' Major Reclamation Award. "We are constantly working toward developing a cleaner future," said Doreen Cole, EPCOR Vice-President...

– Alberta Chamber of Commerce website:

<https://www.acr-alberta.com/category/major-reclamation-award/>

[accessed: July 28, 2021]

The Order of the Bighorn

Established in 1982, the Order of the Bighorn recognizes Albertans for their exceptional volunteer efforts towards fish, wildlife, and habitat conservation. Since its inception, the award has honoured 114 individuals and organizations for their contributions. In addition to recognition, winners receive the distinguished Bighorn sheep bronzed bust. The Rocky Mountain Bighorn Sheep is Alberta's official mammal, embodying the diverse wildlife and resources of the province.

The awards also acknowledge the importance of ongoing stewardship of our natural resources. Members of the Order of the Bighorn have distinguished themselves and



enriched the lives of all Albertans through their commitment to the environment and Alberta's world-renowned fish and wildlife.

Cardinal River Coals Ltd. (Teck Coal Limited)

- 1991, Teck Coal Limited, (formerly Cardinal River Coals) received the Order of the Bighorn Award by the Alberta Government for its contribution to wildlife conservation through land reclamation efforts, particularly in regard to bighorn sheep habitat;
- 1994, Teck Coal Limited, (formerly Cardinal River Coals) received a citation from Alberta Chamber of Resources in recognition of the company's quality of submission for Mine Permit Application and Environmental Impact Assessment for the 50-A-8 pit development.
- In 2006 Cardinal River Operations received the Alberta Chamber of Resources Major Reclamation Award for Sphinx Lake reclamation work.

APPENDIX III. ALBERTA FISHING REGULATIONS (2021) FOR LOVETT AND SILKSTONE LAKES

The 2021 Alberta fishing regulations include the following information for Lovett and Silkstone Lakes. Both are reclaimed mine pits in the Coal Valley Mine south of Robb, Alberta

Fishing Zone ES2 – Does not include Lovett Lake

Fishing Zone ES3 – Lovett Lake and Silkstone Lake

Lovett Lake:

Trout Total: 1 trout over 40cm. Open all year, bait ban enforced. All fish listed on the regulations are WALL, NRPK, YLPR, LKWH, BURB, LKTR, RNTR.

Note: All these fish have empty cells indicating the species is not likely present at that waterbody; however, if caught the default regulations for the Watershed Unit apply. This lake is stocked with Rainbow Trout (see My Wild Alberta below).

Silkstone Lake:

Trout Total: 1 trout over 40cm. Open all year, bait ban enforced. All fish listed on the regulations are WALL, NRPK, YLPR, LKWH, BURB, LKTR, RNTR.

All these fish have empty cells indicating the species is not likely present at that waterbody; however, if caught the default regulations for the Watershed Unit apply. This lake is stocked with Rainbow Trout (see My Wild Alberta below).

MY WILD ALBERTA (MWA) [FISH] STOCKING MAPS

Lovett Lake

Zone Regulations: ES2

Fishing Information: Species Present: Rainbow Trout

General Information: Site Description: There are maps at the trailhead, the lake is in approximately 2km. Hiking or biking only to access lake.

TAKE NOTE: On My Wild Alberta, Lovett Lake is identified as being in Zone ES2. In the Alberta Fishing Regulations both Lovett Lake and Silkstone Lake are located in the ES3 regulation maps.

Silkstone Lake

Zone Regulations: ES3

Fishing Information: Species Present: Rainbow Trout

General Information: Site Description: This lake is a reclaimed mine site.

Legend: As examples, '3 over 63 cm' indicates a possession and size limit of '3 fish each over 63 cm' or '10 fish' indicates a possession limit of 10 for that species of any size. An empty cell indicates the species is not likely present at that waterbody; however, if caught the default regulations for the Watershed Unit apply. SHL=Special Harvest Licence, BKTR = Brook Trout, BNTR=Brown Trout, BURB = Burbot, CISC = Cisco, CTTR = Cutthroat Trout, DLVR = Dolly Varden, GOLD = Goldeye, LKTR = Lake Trout, LKWH = Lake Whitefish, MNWH = Mountain Whitefish, NRPK = Northern Pike, RNTR = Rainbow Trout, SAUG = Sauger, TGTR = Tiger Trout, WALL = Walleye, YLPR = Yellow Perch. Regulation changes are highlighted blue. Waterbodies closed to angling are highlighted grey.

ES3 - Lakes, Reservoirs and Ponds											
Waterbody	Waterbody Detail	Season	Bait	WALL	NRPK	YLPR	LKWH	BURB	LKTR	RNTR	Trout Total
Bear Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	0 fish	1 over 63 cm	15 fish					
Blue Lake		OPEN MAY 15 TO MAR. 31	Bait allowed		0 fish	15 fish	10 fish				
Busby Lake	6-51-1-W6	OPEN ALL YEAR	Bait ban								0 trout
Cache Lake		OPEN MAY 15 TO MAR. 31	Bait allowed		0 fish	15 fish	10 fish				
Chip Lake		OPEN MAY 15 TO MAR. 31	Bait allowed		3 fish			2 fish			
Embaras Pit Lakes	NW-25-47-21-W5	CLOSED ALL YEAR									
Fickle Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	0 fish	0 fish	15 fish	10 fish				
	Tributaries and outlet	OPEN JUNE 16 TO OCT. 31	Bait allowed	0 fish	0 fish	15 fish	10 fish				
Graveyard Lake		OPEN MAY 15 TO MAR. 31	Bait allowed		0 fish		10 fish				
Gregg Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	1 fish	0 fish		10 fish				
Horseshoe Lake		OPEN MAY 15 TO MAR. 31	Bait allowed		3 fish	15 fish					
Jarvis Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	1 fish	0 fish	15 fish	10 fish				
Lac Des Roches	13-47-24-W5	CLOSED ALL YEAR									
Long Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	1 fish	3 over 63 cm	15 fish					1 trout over 40 cm
Lovett Lake	10-47-19-W5	OPEN ALL YEAR	Bait ban								
Millers Lake	8-53-19-W5	OPEN ALL YEAR	Bait allowed								2 RNTR; 0 TGTR
Minnow Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	0 or SHL tags	0 fish	15 fish					
	Tributaries and outlet	OPEN JUNE 1 TO OCT. 31	Bait allowed	0 or SHL tags	0 fish	15 fish					
Mystery Lake	24-48-26-W5	OPEN ALL YEAR	Bait ban								0 trout
Pit 24 Lake	15,16, NE4-47-19-W5	OPEN ALL YEAR	Bait ban								1 trout over 40 cm
Pit 35 Lake		OPEN ALL YEAR	Bait ban								1 trout over 40 cm
Pit 44 Lake	SW 35-46-19-W5	OPEN ALL YEAR	Bait ban								1 trout over 40 cm
Pit 45 Lake	24-46-19-W5	OPEN ALL YEAR	Bait ban								1 trout over 40 cm
Rock Lake	52-2-W6	OPEN MAY 15 TO SEPT. 15	Bait ban		0 fish				3 over 50 cm	0 fish	
Shiningbank Lake		OPEN MAY 15 TO MAR. 31	Bait allowed	0 or SHL tags	0 fish	5 fish	10 fish				
	Tributaries	OPEN JUNE 16 TO OCT. 31	Bait allowed	0 or SHL tags	0 fish	5 fish				0 fish	
Silkstone Lake	9-47-19-W5	OPEN ALL YEAR	Bait ban								1 trout over 40 cm
Unnamed (Lodgepole) Pond	NE-01-48-10-W5	OPEN ALL YEAR	Bait allowed								2 trout
Unnamed (Sphinx) Lake	NE-6-48-24-W5	CLOSED ALL YEAR									
Wolf Lake	SE-12-49-15-W5	OPEN MAY 15 TO MAR. 31	Bait allowed	1 fish	1 over 63 cm	15 fish					
	Tributaries to lake and outlet	OPEN JUNE 16 TO OCT. 31	Bait allowed	0 fish	1 over 63 cm	15 fish					

<https://albertaregulations.ca/fishingregs/ES3-Lakes.pdf>